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Part IV

# Department of Energy

## Coal Competition Prospects for the 1980's: Request for Written Comments on Draft Report

## DEPARTMENT OF ENERGY

### Coal Competition Prospects for the 1980's: Request for Written Comments on Draft Report

**AGENCY:** Office of Competition, Department of Energy.

**ACTION:** Solicitation of Written Comments.

**SUMMARY:** The Powerplant and Industrial Fuel Use Act, Section 742, requires the Department of Energy, in conjunction with 13 government agencies, to conduct a study of competition in the coal industry. Section 742 also requires that a draft report be published and written comments solicited prior to transmission of the final report by the President to the Congress. In keeping with this statutory directive, written comments are solicited on the summary accompanying this notice and on the complete draft report. These comments will be evaluated and incorporated, where appropriate, prior to transmission of the final report to the Congress.

**FOR FURTHER INFORMATION CONTACT:** Leonard L. Coburn, Ernest R. Pantos, Department of Energy, Office of Competition, Policy and Evaluation, 1000 Independence Avenue, SW., Mail Stop 7E–088, Washington, D.C 20585, (202) 252–5680.

**SUPPLEMENARY INFORMATION:**

I. Background
II. Specific Comments Requested
III. Comment Procedures

#### I. Background

On November 9, 1978, Pub. L. 96–620, The Powerplant and Industrial Fuel Use Act (PIFUA) was signed into law. Section 742 of PIFUA requires that the Department of Energy, in conjunction with the Federal Trade Commission, the Department of Justice, the Federal Energy Regulatory Commission, the Department of the Interior, the Department of Transportation, the Department of Commerce, the Department of Labor, the Department of State, the Department of the Treasury, the Interstate Commerce Commission, the Council of Wage and Price Stability, the Tennessee Valley Authority, and the Appalachian Regional Commission, study competition and performance in the coal industry. Prior to final transmission of the report by the President to the Congress, Section 742 requires that a draft report be published and that an opportunity be given for the submission of comments for a period of ninety days. Where appropriate, the comments are to be incorporated into the draft report and a final report should be transmitted by the President to the Congress. Appearing below is a summary of the draft report. The complete draft report is available from the Department of Energy.

#### II. Specific Comments Requested

The Department of Energy and the 13 other government agencies are interested in receiving written comments on any part of the draft report. Comments can be general in nature or can address specific sections of the draft report that are of particular interest to the reader. Each comment will be carefully considered and incorporated into the draft report, where appropriate.

#### III. Comment Procedures

You are invited to submit written comments with respect to the areas indicated above. Comments should be submitted to the following address:

Department of Energy, Office of Competition, Policy and Evaluation, 1000 Independence Avenue, SW., Mail Stop 7E–088, Washington, D.C. 20588.

Comments should be clearly identified on the outside of the envelope with the designation "Coal Competition Comments." Ten copies should be submitted. All comments will be available for public inspection in the DOE Reading Room at the above address.

The comment period will end 90 days after the issuance of this notice.

Issued in Washington, D.C.

**Lester P. Silverman,**

*Principal Deputy Assistant Secretary for Policy and Evaluation.*

January 29, 1981.

### Coal Competition: Prospects for the 1980s

*Summary Draft Report*

January 1981.

Prepared by: Leonard L. Coburn and Ernest R. Pantos

U.S. Department of Energy, Assistant Secretary for Policy and Evaluation, Office of Competition, Washington, D.C. 20585

### Coal Competition: Prospects for the 1980's

*I. Introduction*

The increasing cost of U.S. dependence on oil, much of it imported, and, to a lesser degree on gas, are prompting the United States to develop alternative domestic energy resources. Of these, the most obvious is coal, for the United States has vast supplies relatively widely distributed throughout the country. But having the coal is one thing, producing it in sufficient quantity and pricing it competitively are another.

Between those goals is the coal industry. The United States must look to the coal industry to help it produce coal as an attractive alternative to oil and gas. At the same time, the United States must ensure that the industry operates competitively and prices its product accordingly. Otherwise, given the difficulties of adjusting from one fuel to another, encouraging coal usage and thereby developing a reliance upon it may do little more than substitute a costly dependence on a domestic coal oligopoly for a costly dependence on a foreign oil cartel.

In the context of the current energy problem, the importance of competition in the coal industry is virtually self-evident. For this reason, an assessment of the role and status of competition in the coal industry is indispensable to ascertaining those areas in which Federal involvement is necessary or not and recommending options for Federal action. To these ends, this report presents the finding of a survey and an analysis of the past, present, and projected conditions affecting competition in the coal industry.

A. Historical Perspective

The industrial revolution and its need for cheap fuel made coal the principal energy source of the United States by the end of the 19th century (90 percent of U.S. energy consumption by 1890). The advent of the automobile as well as residential and commercial oil-and gas-fired burners in the 20th century led to a decline in coal consumption as oil and gas were substituted for coal. During the 1940s and 1950s. as large coal users, transportation, residential and commercial, and industrial (expect steel), switched to more convenient and cheaper oil and gas, electric utilities became the largest consumers of coal.

As a result, the production of bituminous coal during the first half of the 20th century fluctuated between 300 million and 630 million tons per year. Production slumped through the 1950s and 1960s, but it has risen steadily in the 1970's, surpassing the 1947 peak in 1975, with 648 million tons.

The coal industry traditionally has been an Eastern-based industry, centered in Appalachia, relying on many rather small mines owned primarily by companies producing only coal. In 1945, for example, about 75 percent of the nation's total coal production came from Appalachia, the top 50 producers produced only about 44 percent of production, and small producers of 100,000 tons or less produced about 18 percent of national production. But by 1978, total Midwest (24 percent) and Western (23 percent) production almost

equalled Appalachian (53 percent) production, the top 50 producers produced about 61 percent of total production, and small producers of 100,000 tons or less produced only about 8 percent of national production.

Paralleling these trends is a shift in the method of mining, from mainly underground mining, which represented 81 percent of coal produced in 1945, to mainly surface mining, which represented 63 percent of coal produced in 1978. This shift is more dramatic on a regional basis. In 1945, surface mining represented 15 percent of Appalachian production, 35 percent of Midwest production, and 16 percent of Western production. By 1978, surface mining represented 49, 70, and 89 percent, respectively. The trends both in the size and method of production have resulted from the need to supply large quantities of coal from a single source to large electric power generating units. Moreover, whereas ownership of large mines has traditionally rested in the hands of coal or steel companies, the trend today is toward ownership as a subsidiary of an oil, gas, nuclear, electric utility, or other type of conglomerate.

Between 1978 and 1990, the role of coal in the U.S. energy supply/demand picture is expected to change substantially. On a BTU basis, both the supply and demand of coal are projected to nearly double by 1990, which oil and gas usage remains stable or declines. The basis of these projections is the rapidly escalating prices of oil and gas, which will prompt adjustments toward relatively more economical energy resources, mainly coal.

Some sectors of the economy are expected to shift more rapidly to coal usage than others in the next 10 years. The electric utility industry, the dominant consumer of coal, is expected to increase its consumption up to 80 percent, and other industries are expected to double their consumption. In addition, synthetic fuel production will create a new market for coal in the 1990s. This market, which consumed almost no coal in 1978, is expected to consume nearly 100 million tons by 1995. At the same time, the transportation and residential and commercial sectors will remain substantial users.

To meet this increasing demand, coal production is projected to grow at an annual rate of about 5 to 6 percent through 1990. The greatest growth will occur in the West, whether it is expected to account for 39 percent of production in 1990 and 47 percent by 1995. This shift in production, from an industry based largely in the East to one distributed more evenly among several regions presages some enormous changes in the makeup of the industry and its competitive characteristics.

## B. Governmental Perspective

As the costs of dependence on oil and gas have become increasingly evident, both government and industry have emphasized the need to substitute coal and other energy resources for oil and gas. The National Energy Act (NEA) created the initial framework for concerted government and private-sector actions to promote the adjustment from one fuel resource to another. As an adjunct of NEA, the Powerplant and Industrial Fuel Use Act (PIFUA) imposes an official prohibition, except in certain circumstances, against large industrial and electric utility oil- and gas-fired boilers. Recognizing that many new generating units would rely on coal as a result of this prohibition, Congress provided in Section 742 that the Department of Energy (DOE), with 13 other government agencies, study competition in the coal industry.[1] The intent of that Section is to elicit an assessment of the effects of legislation and other factors on coal production and industry competition. This study is that assessment.

This study is, by no means, however, the first study of competition in the coal industry. Private-sector organizations have published many studies of the subject. Recently, four government agencies have published studies which now serve as a foundation for this study.

The Federal Trade Commission (FTC) study surveyed 107 companies and reported in-depth data on reserves, production and shipments, among other things, between 1964 and 1974.[2] Its analysis of that data presented findings on the structure of the coal industry. The best examination of production and reserves up to that time, the study is now somewhat dated because of more recent changes in the world energy market.

The Department of Justice (DOJ), as required by the Federal Coal Leasing Amendments Act (1976) to provide annual reports on the state of competition in the coal industry, issued its first report in May 1978.[3] Basing much of its analysis on the FTC data, this report surveys the competitive process in the coal industry and discusses the nature of coal, its manner of trade (presenting its definitions of product and geographic markets), and the nature of competition in coal, with emphasis on concentration and entry in its defined markets. However, DOJ's mandate led it to focus on Federal leasing of coal to a variety of companies, including coal, oil, nuclear, electric utility, and railroad companies. DOJ's second competition report issued in mid-1979 focused on an in-depth analysis of the metallurgical coal market.[4] Its third competition report, issued in November 1980 focuses on coal transportation and the competitive implications of railroad ownership of coal.[5] Portions of this third study are included in this competition analysis.

The General Accounting Office (GAO) report uses the FTC data for its analysis of concentration with some observations on conditions of entry.[6]

Finally, the Tennessee Valley Authority (TVA) report in its initial version and its recent revision presents a legal brief outlining the legal requirements for an analysis of competition and focuses its prime attention on oil company participation in the coal and nuclear industries.[7]

Collectively, these studies present a rather comprehensive analysis of competition in the coal industry. But they are unavoidably dated by their reliance on FTC data. Moreover, because of their particular interests, they discuss some areas only summarily, others not at all. This competition study begins where these end.

## C. Problem, Scope, and Methodology

The need to ensure energy supplies at economic costs makes competition in the coal industry an important national concern. Any effort to help the industry realize the hopes placed on it requires an understanding of current conditions

[1] The Federal Trade Commission, the Department of Justice, the Federal Energy Regulatory Commission, the Department of the Interior, the Department of Transportation, the Department of Commerce, the Department of Labor, the Department of State, the Department of the Treasury, the Interstate Commerce Commission, the Council on Wage and Price Stability, the Tennessee Valley Authority, and the Appalachian Regional Commission.

[2] Richard B. Smith and Ernest R. Pantos, *The Structure of the Nation's Coal Industry, 1964–1974*, Staff Report to the Federal Trade Commission (Washington, D.C.: Government Printing Office, November 1978).

[3] U.S. Department of Justice, *Competition in the Coal Industry* (Washington, D.C.: Government Printing Office, May 1978).

[4] U.S. Department of Justice, *Competition in the Coal Industry* (Washington, D.C.: Government Printing Office, May 1979).

[5] U.S. Department of Justice, *Competition in the Coal Industry* (Washington, D.C.: Government Printing Office, November 1980).

[6] Comptroller General of the United States, *The State of Competition in the Coal Industry* (Washington, D.C.: General Accounting Office, December 1977).

[7] Herbert S. Sanger, Jr. and William E. Mason, *The Structure of the Energy Markets: A Report of TVA's Antitrust Investigation of the Coal and Uranium Industries* (Knoxville, TN: TVA, June 1977) and *1979 Update* (February 1979).

and present trends in order to ensure its continued competitiveness. The purpose of this report is to assess the current and projected conditions of competition in the industry and to determine in what ways it is possible to ensure the desired production of coal while minimizing the costs to the nation.

The contrast between this study and previous ones indicates both its scope and major concerns. This study of competition provides a basis for assessing the competitive process in the coal industry by developing and applying a methodology for examining the conditions of competition. At the same time, it diagnoses the limitations of present analytic tools.

Whereas other studies have stressed competition in the coal industry at a particular time, this study stresses the changing conditions of competition over extended periods of time. It will focus on the dynamics of the industry, that is, those forces which shape and change industry, but it will also depict the industry as it is at the moment, the static perspective.

Both dynamic and static representations of competition require an assessment of the two indispensable structural variables in an analysis of competition, concentration and entry conditions. This study will explain why these variables are important, what their use in analysis of competition can reveal, and how the results of their use can serve as a guide to assessing the present state of competition in the coal industry and the prospects for competition in the next decade. Particular attention is devoted to an in-depth examination of the principal participants in the coal industry, namely, the oil, gas, nuclear, electric utility, and railroad companies and to the questions about how their participation affects the competitive process and what, if anything, should be done about it now or in the future.

Finally, in its major departure from previous government studies, this study examines the relationship of the Federal government to the coal industry and analyzes the effects, actual or potential, of Federal involvement on present or prospective competition in the industry. In light of its findings, the study concludes with a number of options to protect and promote competition in the coal industry today and in the next decade.

This study uses throughout the analytic paradigm normally used in competition studies, a structure-behavior-performance analysis. Since competition is the focus of this study, this paradigm has been developed as the most effective way to depict the industry in both its static and dynamic modes.

The development of the analytic paradigm enables the policymaker to assess the present state of competition of the coal industry, to assess the impact of present policies on that state of competition, and to assess future competitiveness. If perfect competition in the market existed, there would be no need for the intervention of the government in the market since there would be no market imperfections requiring correction. However, perfect competition in the market is rarely approached. As a result, a series of market imperfections develop that may or may not require government intervention. Competition analysis can assist the policymaker in determining the need for and degree of government intervention. One goal of this study is to consider how some forms of government intervention affect the competitive process in the coal industry, whether that intervention is likely to be or has been beneficial or detrimental, and whether emerging issues require government intervention.

This study uses the economic concept of competition in two ways, first, as a characteristic of the structure of the industry and, second, as a characteristic of the performance of the industry. In the first, structural sense, an industry is said to be competitive only when the number of firms selling a homogeneous commodity is so large and each individual firm's share of the market is so small that no individual firm can influence the price of the commodity significantly by varying the amount that it sells. In the second, performance sense, competition serves to discipline industry members to provide goods and services skillfully and cheaply. Competition as used in this study should not be confused with the more common businessman's use of the term, which means striving against other businessmen for patronage. This activity is more properly called rivalry and is not the same as the economic sense of the term competition as used in this study. Both senses overlap in their implications of dispersed private economic power and the necessity of efficient utilization of resources.

The structural aspect of the paradigm focuses on two primary variables, seller concentration and conditions of entry. Seller concentration is a useful predictor of dominance of a few firms in the market (both geographic and product) since judgments can be drawn about the ability of firms to coordinate pricing and production policies. In its simplest form, the smaller the number of sellers in a market, the more likely it is that they can arrange a coordinated policy for raising prices or restricting production without the need to openly collaborate merely by being mutually aware of the impact of one firm's pricing and production decisions on other firms. The index used most often in seller concentration analyses is the concentration ratio, which measures the ratio of production or sales of a predetermined number of firms, usually the top four and eight firms, to the total industry output or sales.

The second primary structural variable is conditions of entry. Even if the existing producers or sellers in an industry were able to coordinate pricing and output policies perfectly, their ability to raise prices above competitive levels or to restrict production below competitive levels is limited by the ability of newcomers to enter the business and take a share of the market. If entry is easy, the potential competition from new entrants has a disciplining effect on price and output. The structural analysis must, therefore, determine whether entry conditions are high or low in order to judge whether the industry is competitive.

Whatever the structure of any industry, an analysis of competition must examine how firms are behaving and performing. Behavior and performance are factors neither independent of one another or from structure since behavior and performance can affect structure. The interplay among the three often makes sharp distinctions among them difficult.

The focus in this study is on the latest data on seller (producer) concentration, the factors that change seller concentration (market dynamics), and the conditions of entry. Government intervention in the market is a major concern in each. The behavior-performance analysis focuses on the major industry participants and how their participation affects the competitiveness of the coal industry.

This study benefits, of course, from more recent information than that available to previous government studies. It uses 1978 as the reference year since that is the latest year for which complete production data are available.

The study relies on a variety of data sources. The most important are: DOE/EIA Form 7, Bituminous Coal and Lignite Production and Mine Operation (EIA 7), for the year 1978; various Keystone publications; the 1979 EIA Administrator's Report to Congress; and various EIA policy studies. In addition, new data were collected by DOE for use in the section in oil, gas and nuclear

companies; by the Federal Energy Regulatory Commission (FERC) in its sections on electric utility captive coal and contracting; and by the DOJ in its section on railroads. A complete list of references is provided in the bibliography.

*II. Structure*

The competition analysis of the structure of the coal industry, focuses on two primary variables: seller concentration and conditions of entry. Although both are affected by other factors and each other, they will be separately discussed in the following two sections.

A. Seller Concentration

1. Theory and Relevance. The importance of seller concentration as a determinant of market outcomes (i.e., economic performance) arises from the theory that there is a positive relationship between the degree of interdependence among sellers in a market and the likelihood of those sellers, engaging in cooperative behavior, with the result noncompetitive performance. The level of seller concentration measures the number and size distribution of sellers in a market. One common measure of seller concentration is the concentration ratios of the output of the four and eight largest producers to the output of all producers in a market. Stated somewhat simplistically, high concentration levels indicate that a small number of companies account for a large share of total market output and that an increased degree of interdependence exists among sellers. Although there is no clear level of concentration above which an industry becomes noncompetitive, there appears to be widespread agreement that a four-firm ratio below 50 percent indicates that anticompetitive coordination would be unlikely.

2. Measurement Problems. Any analysis based upon the level of seller concentration in a market has little meaning unless the concentration measures are based upon reasonably accurate definitions of markets, which are defined, with difficulty, by identifying product and geographic boundaries.

Economic theory provides some basic principles for defining markets. The basic criterion is the degree of economic substitutability between goods and between similar goods from different geographic areas. Difficulty arises, however, because economic theory provides no guidance about how substitutable goods must be in order to belong to the same market. A considerable degree of judgment is necessarily involved.

The dynamic nature of coal markets is only one of several reasons why it is difficult to delineate market boundaries. Competitive relationships are necessarily complex, especially in the case of a product such as coal, with significant variations in qualities, the geographic distribution of these qualities, and mining methods and costs. The overlay of a matrix of government regulation and the resulting uncertainty serves to multiply the complexity of these relationships and to make it more difficult to delineate boundaries. Reasonable market boundaries, however, can be established and are valuable to policymakers concerned with competition.

a. Product Boundaries. Product boundaries in the case of coal depend upon the degree of substitutability, based upon technical and economic factors, between coal and other energy sources and (given the wide variation in the characteristics of coal) between different types of coal in particular end uses. Even though all fuels serve basically the same function and certain fuels may substitute for coal in some instances, the degree of substitution between coal and oil, gas, or nuclear fuel is sufficiently limited that coal can be regarded as trading in a market that is distinct from markets for other fuels.

Regarding differences in the qualities of coal industry participants recognize a clear distinction between the market for high-quality bituminous metallurgical coal and the market for steam coal.[8] Within the metallurgical coal market, there are several submarkets based on volatility. Separate product markets may exist for low-, medium-, and high-volatile prime coking coal.

Regarding the distinction between spot and long-term steam coal contracts, it can be argued that the two categories are part of the same braod market, since buyers and sellers can and do arbitrage between the spot and contract "markets." When spot prices are temporarily at a premium, some suppliers of long-term contract coal reduce the quality and quantity of deliveries under their contracts in order to move more coal into the spot market. Even in the West, where contracts are not easily broken, terms are renegotiated in light of changes in spot prices.

[8] Although price differentials still indicate the existence of distinct steam and metallurgical coal markets, mounting evidence points to increasing substitution by users of both, and thus to some blurring in the boundaries between these two products.

b. Geographic Boundaries. The coal resources of the United States are distributed among eight major coal provinces. Due primarily to high transport costs, the degree of interregional substitution (i.e., the ability of coal from one area to compete with that from another) is limited. In recent years, greater use of unit trains, increased mining costs, and higher coal prices have lowered the ratio of coal transport costs to the delivered price of coal and thereby increased the geographic scope of coal markets. Transport costs are still high enough, however, that coal is bought and sold in regional markets rather than in a single national market.

This study uses four geographic markets, Appalachian, Midwestern, Western, and Midwestern-Western combined.[9] The first three regional breakdowns follow traditional producing regions. This study uses these breakdowns rather than more refined market boundaries because of its focus on those dynamic factors which change markets rather than on factors requiring carefully constructed static boundaries. The Midwestern-Western region recognizes changing markets because of a host of factors and presents a roughly constructed market merely by combining the Midwestern and Western regions. The four previous government competition studies utilize more refined geographic markets; however, they are somewhat similar to the ones presented in this study.

The recent government reports on competition in the coal industry disagree in defining geographic market boundaries for steam coal. The FTC study grouped the eight producing provinces into three geographic markets: Appalachian, Midwestern, and Western. The study noted that several factories, particularly the Clear Air Act Amendments of 1970, have caused increasing amounts of low-sulfur Western coal to flow into the Midwest, resulting in a combined "Midwest and West" market. However, this trend is being slowed by subsequent legislation, such as the Clean Air Act Amendments of 1977, which require the use of local coal to minimize local economic disruption or unemployment, and the Surface Mining Control and Reclamation Act of 1977, which narrows the production cost gap between strip and underground mining. The 1978 DOJ study identified four distinct markets by separating the Western market into a Northern Plains market and a

[9] The terms "Midwestern" and "Interior" are used interchangeably in this study. Chapter V of the full report indicates the composition of these markets.

Southwestern market. The GAO report contains yet another geographical configuration: three markets with slightly different boundaries from the FTC report. Apparently, the different geographic market delineations of the three government reports were the result of both conceptual and methodological differences. However, this disagreement did not result in substantial differences in the conclusions reached by the various reports.

Geographic boundaries for metallurgical coal are delineated most carefully in the 1979 DOJ study, which identifies distinct West and "West and Midwest" markets for coking coal. The study also finds that the North and Central Appalachia region and the low- and medium-volatile Alabama coking coal market are significantly insulated from competition from other coal regions.

c. Defining Economic Activity. A major issue in constructing concentration measures is the proper definition of the industry's economic activity. The issue is whether measures of current activity, such as sales or production, are adequate or whether measures of future productive ability, such as ownership of reserves, are more meaningful. The importance of this issue is greatest in the case of an exhaustible resource like coal. With a depletable resource, it is possible that a company's large market share in terms of current production might be a poor indicator of the firm's future position in the industry if its reserve position were relatively smaller by comparison. A large producer of coal today may not be a producer or an important producer in the future. The firm's future position depends critically on the amount of reserves it possesses and on its ability to maintain a reserve position. Conversely, a firm may have little current production but large reserves which it is just beginning to develop.

Coal reserve concentration, however, should not be used as an estimate of future production concentration. Firms may develop their reserves at very different rates, and little can be predicted about future mergers or which firms will enter or exit the industry at what time or changes in ownership of firms, e.g., from Federal leasing. At best, market shares based on coal reserves indicate which firms may be the largest coal producers in the future and suggest possible changes in future production concentration.

A second issue relating to reserves is whether coal on unleased Federal and Indian lands should be included. Due to the leasing moratorium imposed by the Department of the Interior (DOI) from 1971 until recently, the three government studies all have calculated a reserve measure that would exclude unleased Federal reserves and reserves on Indian land. Since the Federal government occupies a key position in Western coal reserve ownership, this adjustment turns out to be very significant in calculating regional concentration ratios.

In June 1979, however, the Federal leasing moratorium was lifted, and the Federal Coal Management Program regulating Federal leasing of coal reserves went into effect. With the resumption of leasing, exclusion of unleased Federal reserves from the total universe base is no longer appropriate. If these reserves were excluded, the concentration measure would overstate the extent of private control over the nation's coal reserves. Under land-use planning criteria and various environmental regulations, however, some reserves will continue to be barred from leasing. Consideration has to be given to how these "not-for-lease" reserves may be estimated and excluded in order to refine the measure of total reserves as a universe base requires additional consideration.

The measurement of concentration levels in coal is further complicated by the extensive use of long-term supply contracts and the presence of "captive" mining operations, coal mines owned by electric utilities. Arguments have been made on both sides of the issue of whether coal production or reserves accounted for by long-term contracts or captive operations should be included in any measure of the total economic activity in coal. This study concludes, however, that both reserves committed under long-term contract and captive production should be included in the relevant coal universes because both represent potential competition. If other sellers were to act jointly and elevate price, the higher price could induce a supply response from both "committed reserves" (those reserves dedicated to long-term contracts) and captive production. Long-term contracts often contain clauses allowing cancellation by either party within a reasonable period, usually one year. In the case of captive production, such production often is able to enter the open market in response to favorable price movements. In fact, there is historical evidence to indicate that this has taken place in the coal industry. In addition, captive production is part of total demand and total supply and plays a role in price determination. Thus, such coal cannot be viewed as totally isolated from the market.

In evaluating the advantages and limitations of these various concentration measures, it should be remembered that no one is superior to the others for all purposes. The measures that conceptually are the most refined and permit the narrowest interpretation of existing market concentration also rely on data that have undergone the most ad hoc adjustments and thus are probably the least accurate. Also, since market concentration is itself only a rough index of potential market power, the incremental benefits of the greater precision in the data should be carefully weighed against the additional cost of obtaining or achieving such accuracy.

3. Seller Concentration Levels.—a. Coal Production Concentration. The levels of seller concentration found in this study do not change the competitive implications drawn from the findings of previous government studies that used various narrower market breakdowns. However, because market boundaries can change rapidly, this study analyzed dynamic factors instead of developing more refined market boundaries. Table 1 presents the concentration ratios for national and regional coal production in 1966 and 1978. The regional breakdowns are based upon major coal producing areas, Appalachian, Midwestern, Western, and Midwestern-Western combined.

**Table 1.**—*Concentration Percentages Nationally and Regionally*

| Region | Percentage of production accounted for by | | | |
|---|---|---|---|---|
| | Top 4 firms | | Top 8 firms | |
| | 1966 | 1978 | 1966 | 1978 |
| Total U.S. | 27.6 | 21.3 | 37.4 | 28.7 |
| Appalachian | 23.7 | 16.2 | 33.2 | 24.5 |
| Midwestern | 61.1 | 45.1 | 84.0 | 62.7 |
| Western | 31.3 | 37.3 | 53.6 | 58.9 |
| Midwestern-Western | 53.1 | 36.9 | 74.2 | 50.6 |

Table 1 shows that 1978 coal production concentration was low nationally and in the Appalachian and Western regions. Concentration was higher in the Midwestern region, but it fell significantly from 1966 levels. Concentration levels also fell in the Appalachian region, but increased in the Western region. The evolution of a combined Midwestern-Western region shows that concentration has fallen dramatically over the period. Presently, the four-firm seller concentration ratio does not exceed 50 percent in any region.

b. Coal Reserve Concentration. The issue of the adequacy of coal reserve information has received considerable attention in a number of studies. The

recurring problem associated with the data from the Bureau of Mines (BM) is its variability and lack of adequate discreteness. The estimation of coal resources as opposed to reserves has been done on no more than a conjectural basis. Coal resources indicate the total amount of coal available, whether identified or undiscovered. Identified resources include those that have been measured or indicated and these two categories constitute reserves. The remaining categories, inferred, hypothetical and speculative, plus the reserves constitute total resources. The last three measurements really are no more than a best guess. As a prognostication for crude planning purposes the use of the coal resource total may be adequate; however, for the degree of precision required for universe figures used in competition studies, it may be inadequate.

The measurement of a demonstrated reserve base (measuring in-place reserves) has been done with more attention to what is actually available; however, this data base is quite flawed as well. It has been criticized for overestimating the economic coal reserves available by not excluding the reserves that are not ready for economic mining due to the entire range of legal and economic restrictions and problems associated with assembling logical mining units (a statutory concept found in the Federal Coal Leasing Amendments Act). On the other hand, it is argued that the definition for including reserves in the demonstrated reserve base may be so strict that significant amounts of coal are excluded from the reserve base. This problem underestimates the universe figures. Combined, the two problems cut in opposite directions, with no adequate basis for determining their relative magnitudes. These are but a few of the problems that are encountered in using the present coal reserve data. A more complete discussion can be found in the studies indicated above.

The FTC study endeavors to correct some of these problems. The data compiled were the most accurate of its kind; however, significant data and conceptual problems remained. The three recent government coal competition studies all rely on the data collected by the FTC, although they apply them in varying ways. In each of the studies, as reflected in Tables 2 and 3, coal reserve concentration was found to be substantially lower than coal production concentration.

**Table 2.**—*Concentration Ratios for Bituminous and Lignite Coal*

| Concentration measure | DOJ/FTC/GAO (Appalachia) | | DOJ/FTC (Midwest) | | FTC (Western) | | FTC (Midwest and Western) | | DOJ (Northern Plains) | | DOJ (Southwest) | | DOJ/FTC (United States) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 4 firms | 8 firms | 4 firms | 8 firms | 4 firms | 8 firms | 4 firms | 8 firms | 4 firms | 8 firms | 4 firms | 8 firms | 4 firms | 8 firms |
| Production (1964) | 20.1 | 29.4 | 56.1 | 77.1 | 33.1 | 50.9 | ..... | ..... | | | | | | |
| Production (1969) | 25.7 | 37.3 | 60.7 | 82.7 | 33.6 | 55.8 | ..... | ..... | 63.1 | 100.0 | 48.2 | [1] 49.0 | 23.8 | 33.7 |
| Production (1974) | 22.3 | 32.5 | 56.1 | 72.7 | 34.3 | 51.3 | 44.3 | 57.6 | 56.7<br>37.7 | 77.5<br>62.9 | 53.8<br>64.1 | [1] 58.4<br>[1] 75.4 | 26.2<br>25.0 | 36.7<br>34.8 |
| Total reserves (1974) | 15.2 | 22.8 | 22.0 | 28.6 | 13.9 | 20.1 | 15.4 | 20.5 | 14.3 | 22.1 | 29.7 | 39.8 | 13.3 | 18.3 |
| Uncommitted reserves (1974) | 19.3 | 25.7 | 25.6 | 31.7 | 13.5 | 19.0 | 15.8 | 21.1 | 13.7 | 20.5 | 25.4 | 34.7 | 14.8 | 20.3 |
| Total non-Federal reserves (1974) | 15.2 | 22.8 | 22.0 | 28.6 | NA | NA | NA | NA | 42.8 | 66.0 | 67.9 | 91.0 | 20.0 | 27.5 |
| Uncommitted non-Federal reserves (1974) | 19.3 | 25.7 | 25.6 | 31.7 | NA | NA | NA | NA | 46.9 | 70.2 | 66.3 | 80.6 | 25.5 | 34.9 |

[1] Only five firms in 1964 and six in 1969 and 1974 included in FTC Survey.

Source: FTC data: Bureau of Mines, Department of Interior, *Minerals Yearbook*. Table compiled from: Federal Trade Commission, *The Structure of the Nation's Coal Industry*, Bureau of Economics, November 1978, pp. 38, 40, 41, 42, 45, 81–84, 89; and Department of Justice, *Competition in the Coal Industry*, May 1978, p. 63; and General Accounting Office, *The State of Competition in the Coal Industry*, December 1977, p. III–4.

**Table 3.**—*GAO Concentration Ratios for Bituminous and Lignite Coal*

| Concentration measure | Central western | | Southwestern | | United States | |
|---|---|---|---|---|---|---|
| | 4 firms | 8 firms | 4 firms | 8 firms | 4 firms | 8 firms |
| Production (1974) | 44.4 | 55.1 | 97.6 | [1] 100 | 26.6 | 36.7 |
| Total reserves (1974) | 16.5 | 21.8 | ..... | ..... | 13.3 | 18.2 |
| Total non-Federal reserves (1974) | 27.0 | 35.7 | ..... | ..... | 16.8 | 25.5 |

[1] Represents only 5 firms.

Source: FTC Data and Keystone Coal Industry Manual, *U.S. Coal Production by Company, 1974. Table compiled from : GAO, The State of Competition in The Coal Industry, December 1977, pp. II–6, II–12, III–6 and III–11.*

c. Turnover Among Major Producers. High turnover among major producers can be an indication of the absence of market power since entry is relatively easy. There has been considerable change in the composition of the major coal producers from 1966 to 1978. Changes in control or ownership or entry of new major producers have resulted in a significant growth in the number of oil-controlled and utility-controlled majors; the number controlled by steel and independent coal companies has declined. The entrance of new producers controlled by oil companies and utilities has altered the ranking of firms within the major producing class; half of the top ten producers in 1978 did not exist in 1966. This greatly altered ranking is one indication of the dynamic nature of the coal industry.

4. Dynamic Factors Affecting Seller Concentration. Dynamic factors influence, not only the identity of the major coal producers, but also the product and geographic dimensions of coal markets. Among the most important are technological change, and institutional and legal factors such as

environmental and tax laws, fuel choice intervention, transportation, and Federal leasing policy.

a. Technological Change. Technological change is probably the most important long-run determinant of the product boundaries of the market. The historical record clearly indicates that advances in technology increase the set of economically viable possibilities for substitution on the demand side of the market. As a result, product boundaries are pushed outward to encompass a wider set of substitution possibilities. A wide range of fuels are now technologically substitutable in the electric utility, industrial, commercial, and residential sectors of the economy. However, the development of synthetic oil will allow coal to be substituted for crude oil in the production of gasoline and thereby increase the possibilities of substitution in the transportation sector. Whether and when these technological alternatives will become economic substitutes depends on a variety of institutional and legal factors, which are discussed below.

Technological change has important effects on geographic as well as product market boundaries. For example, the development of coal shipment by low-cost unit trains has increased the distance coal can be shipped at a constant delivered price. Coal slurry pipelines are expected to decrease shipping costs in the future, allowing Western coals to compete in more distant markets. As in the case of product markets, the degree to which geographic market boundaries expand in the future will be influenced by institutional and legal factors.

b. Institutional and Legal Factors. Product and geographic market boundaries (and therefore seller concentration levels) respond to a variety of institutional and legal factors. These will be discussed briefly here and expanded upon in the section on the role of government. Whereas technological change usually has long-run effects on the market, new laws and regulations generally have more immediate effects.

Environmental laws have caused massive shifts in coal consumption patterns. The Clean Air Act Amendments of 1970 caused many Midwestern utilities to purchase low-sulfur "compliance coal" from Western coal producers. The subsequent geographic expansion of the market to comprise both the Midwestern and Western regions effectively lowered seller concentration levels, which were higher in the Midwest than in any other region. Additional changes in the environmental laws may alter regional market boundaries again. Although it seems likely that Midwestern utilities will use relatively less Western coal and more local coal, it is too soon to assess the impact this shift will have on regional seller concentration levels.

Government policies restricting fuel choice also affect market definitions since they alter the degree of interfuel substitutability. PIFUA restricts the use of oil and gas in certain new electric steam generators and major industrial fuel-burning installations. Since the high price of oil makes that fuel uncompetitive with coal in these uses anyway, the law has had little actual effect on fuel choice. Coal receives little competition from oil for electric utility plants. Although the fuel-use restrictions may force the use of coal rather than natural gas in some cases, rising natural gas prices also limit the degree of gas usage. Therefore, policies restricting fuel use appear to have had little effect on product or geographic market boundaries.

Federal and state tax programs also can affect market boundaries. State severance taxes are higher in the West than in the East or Midwest. This disparity tends to increase the relative cost of Western coal by comparison to the cost of coal from other regions. Royalty payments on Federal coal leases also have their greatest impact in the West and may tend to increase the cost of Western coal. The removal of coal taxes would have little effect on national coal production, but it would cause a significant shift in production from Eastern and Midwestern to Western coal. Concentration could increase or decrease, depending on how the market boundaries are altered and which firms operate in or enter the markets.

Federal coal leasing policy has a tremendous impact on seller concentration in the West. The Federal government owns approximately 60 percent of Western coal reserves. The extent to which these reserves are made available for leasing has a substantial effect on coal reserve concentration ratios. The rate of leasing and the choice of lands to be leased also have an effect on geographic market boundaries and may determine to some extent which companies will increase their participation in the market. Increased leasing of Federal coal lands should tend to reduce seller concentration since it facilitates the entry of new firms.

5. Summary. As noted in previous sections, the measurement of seller concentration in the coal industry is fraught with numerous conceptual and data problems. However, the results of the present study, combined with the findings of several previous major government studies, indicate that the degree of seller concentration does not pose significant competitive problems in the coal industry. In general, under a wide variety of product and geographic market definitions, seller concentration was found to be low or moderate and decreasing. In those smaller regional markets where concentration was relatively high or increasing, more detailed analysis showed that there were no major competitive problems. It should be stressed that without evaluation of other structural factors, concentration ratios present only limited information upon which to base judgments of competitiveness.

B. Conditions of Entry

Seller concentration is only one element of market structure. A second major variable is the ease of entry into the market by new firms, a factor usually referred to as the "conditions of entry." Even where seller concentration is high, firms do not possess market power if there are no significant barriers to entry. If they were to charge monopoly prices, new firms attracted by the high profits would enter the market, increase output, and drive prices down to competitive levels. There are several barriers to entry into the coal industry, but none of them affect competition significantly at the present time.

1. Economies of Scale. One entry condition that can effectively impose a high entry barrier is the existence of large economic of scale. New entrants can be deterred if the smallest mine required for efficient production is so large that their entry would flood the market and cause coal prices to fall below the profitable level. Of course, this problem is reduced if demand is increasing. An analysis using two different productivity measures (both of which may have significant shortcomings) found evidence of scale economies in coal production. Productivity was positively related to mine size for all regions and mine types examined. This relationship was seldom continuous, and the most efficient size varied among regions, mine types, and productivity measures.

Since there is no clear minimum efficient mine size in the coal industry, this study uses three different measures of scale necessary for entry into coal mining, namely, coal production required for the largest electric generating unit, the average unit, and the average contract size. The largest of these is the coal output necessary to meet the requirements of the highest estimate of average electric utility contract size in the Western region. Even at this large scale (2.9 million tons

per year), the required output represents slightly less than 1 percent of total coal production in the market. Therefore, there is no possibility that the entry of a new firm would drive prices below profitable levels. Although economies of scale exist, they are not substantial enough (relative to total market output) to present a barrier to entry into coal mining.

There may be economies, not only from operating larger mines, but also from operating a large number of mines. The available evidence indicates that there are no significant multiplant scale economies for coal production. For mines of different size, type, and productivity, there was no statistically significant difference in productivity between major coal producers (that tend to own more than one mine) and non-major producers.

2. Capital Requirements. The capital investment necessary to develop a coal mine may form a barrier to entry into the coal industry if new firms cannot raise the required initial capital funds or can do so only on terms less favorable than those for established producers. The intitial capital investment necessary to open a mine depends on several factors, including the method of mining (underground or surface), the type of coal, the thickness of the coal seam, and the depth of overburden. It is clear, however, that the cost of opening a new mine has increased sharply in recent years, partly because of general inflation and partly because of new environmental, and health and safety regulations.

Estimated initial capital requirements for several representative coal mining operations range from $31.5 millin for a strip mine producing three million tons per year to $87 million for an underground mine producing at the same rate. Whether capital requirements such as these present an entry barrier depends on how they are perceived by potential entrants and financial institutions. To a large extent, this perception is likely to depend on the size of the firm. For purposes of analyzing capital requirements as a barrier to entry, it is useful to view the coal industry as being composed of two categories:

(1) A group of large companies including major diversified firms (particularly oil companies), captive mine operations of electric utilities and steel companies, and large independent coal companies. In general, all of these companies either are captive operations or enter into long-term contracts, often for large electric power projects in the West; and

(2) A group of numerous small coal producers, usually located in Appalachia, many of which move in and out of production depending on the state of the spot market for coal.

These two industry categories face quite dissimilar conditions regarding access to financial resources. The large firms in the first category tend to be financially strong and are able to use a variety of financing techniques that rely on the strong credit position of the parent company or the security of long-term contracts. The small companies in the second category do not enjoy these advantages. Small companies have problems in negotiating long-term contracts, primarily because the size of their coal reserves is too small to meet the total requirements of an electric generating plant. Although the coal could be obtained from several mines, there are significant economies in securing coal from one source (e.g., lower transportation and contract negotiation costs).

Therefore, small coal producers generally operate in the spot market and face much greater uncertainties than firms with long-term contracts. Small companies usually obtain funds from regional banks, finance companies, coal brokers, equipment manufacturers and equipment leasing companies. Such financing is usually for shorter time periods and at a higher cost.

Although small companies may not be able to obtain financing on as favorable terms as large companies, this is because they operate in different market segments with different degrees of risk, the capital requirements for entering small-scale coal production are relative low. Since these small firms have moved quite easily into and out of the spot market, there is no reason to believe that capital requirements form a significant barrier to entry into this market category.

In summary, although the initial capital requirements for large mines are quite high, a variety of financing techniques based on the existence of a long-term contract facilitates entry by any company with sufficient economic coal reserves. The initial capital requirements for entering small-scale coal production are not high enough to form a barrier to entry into spot coal markets. In short, capital requirements do not present a significant barrier to entry into the coal industry.

3. Transportation Problems. Lack of adequate coal transportation facilities could present a significant barrier to entry in the future. Entry may be blocked by the inability of transportation systems to handle additional coal traffic or by the lack of new transportation networks necessary to open access to new coal lands.

The National Energy Transportation Study (NETS) has found that congestion already has occurred on several Eastern rail links. By 1990, NETS indicates congestion is projected to occur on 67 links, mostly west of the Mississippi. Coal movement is heavy in most of these corridors. Depending on the actual rate of growth of coal shipments and the capital investment decisions of the railroads, serious railroad bottlenecks could develop.

This potential problem can be ameliorated by the availability of alternative transportation systems, particularly coal slurry pipelines. Although only one coal slurry pipeline is operating presently, several proposed systems are on the drawing board. The potential availability of low-cost pipeline transportation provides an important potential avenue for entry into coal markets by new companies. Efforts to reduce barriers to entry for coal slurry pipelines should be supported.

4. Federal Leasing Policy. Approximately 60 percent of the Western coal reserve base is owned by the Federal Government, and an additional 20 percent is dependent upon the availability of complementary Federal coal for its production. Any decision not to lease Federal coal or to lease inadequate amounts or to lease in inappropriate locations could create a substantial barrier to entry. New entrants would have to obtain coal from those companies holding existing Federal leases or possessing non-Federal sources. In regions such as the Powder River basin, where the great majority of mining sites are dependent upon the availability of Federal coal, new entry into coal mining could be achieved only by purchases of existing leases from their current holders. The implications of this situation are critical since existing lease holders could deny entry entirely merely by being unwilling to sell present leases. Given that a competitive industry requires ease of entry, severe limitations on the availability of Federal coal could create an artificially high entry barrier, shift substantial market power to present industry participants, and undermine the present market structure characterized by low to moderate concentration. Such actions can lead to a much more concentrated industry in future years, with serious implications for the economy.

Moreover, there are many Western coal regions. The choice of areas to lease and the sequence for planning can determine the eventual lessee because

of the pattern of surface ownership rights, economic advantages inherent in possessing adjacent mines or leases, or other access limitations. The failure to systematically develop the coal resource, hydrology, and wildlife data needed for prelease planning of public lands orients lease planning to known areas that are partially leased or are adjacent to existing operations. These areas tend to have land ownership patterns inconsistent with significant new entry prospects. This orientation may be a problem only with the first lease sale since it was undertaken with dispatch to show that coal leasing could resume quickly. Future sales may not be subject to similar failures and orientations.

*III. Behavior and Performance*

It is difficult to judge the performance of firms in an industry directly, particularly in a dynamic natural resource industry such as the coal industry. Prices and profits may be affected by differences in the quality of coal resources and by the transitory effects of disturbances such as coal strikes and the OPEC oil embargo. The progressiveness of the industry can be judged only against the opportunities for technological advance.

The extensive analysis of seller concentration and entry conditions in the coal industry (summarized above) indicates that firms within the industry can be expected to behave in a competitive manner and that performance should approach the competitive ideal. Coal prices increased because of the sharp increase in coal demand after the Organization of Arab Petroleum Exporting Countries (OAPEC) oil embargo and in anticipation of a major coal strike in late 1974. More recently, contract coal prices have risen steadily because of increased production costs. When corrections are made for the effects of inflation, coal prices in constant dollars fell from 1975 to 1979. Spot prices have fluctuated with the rise and fall of coal demand, particularly in response to expected coal strikes. This behavior is consistent with what would be expected in a competitive natural resource market with fluctuating demand.

Although seller concentration levels and entry conditions in the coal industry are conducive to competition, many of the major coal producers are involved in closely related industries. These relationships, known as horizontal or vertical integration, may result in noncompetitive behavior or less than optimal performance. In the case of horizontal integration, the coal producer also produces one or more energy products that compete in the same markets as coal. In the case of vertical integration, the coal producer owns one or more other stages of the production process. For example, many electric utilities produce the coal that is used by them in the generation of electricity.

The following sections analyze the competitive implications of the relationships among the groups of companies within the coal industry: oil, gas, and nuclear firms, whose products may compete with coal; electric utilities, which may produce the coal needed for their own power plants or for the market in general; and railroads, which may own some of the coal that is transported on the railroad networks.

A. Oil, Gas, and Nuclear Companies

1. Entry into the Coal Industry. The entry of petroleum companies into the coal industry has occurred in two periods. During the 1960s, four of the largest coal producers were acquired by oil companies. During the 1970–1978 period, petroleum firms entered the industry through numerous smaller acquisitions, joint ventures, and *de novo* (grass roots) entry. Of the 1978 coal reserves of the petroleum companies that entered coal production during the latter period, 85.6 percent were held by *de novo* entrants (including two joint ventures).

Oil and gas companies accounted for a small proportion of U.S. coal production in 1978. The eight major oil companies produced only 2.9 percent of total output. All coal producers classified as oil and gas companies (a group of 46 companies) accounted for 19.0 percent. The petroleum companies' production shares in regional markets were also low.

The eight majors held 7.1 percent of total United States demonstrated recoverable coal reserves in 1978; the 23 largest domestic petroleum producers held 17.6 percent. When unleased Federal coal reserves are excluded from the reserve base, these percentages rise to 10.2 percent and 25.2 percent, respectively. Although the petroleum companies' shares of coal reserves were higher in some regions, they do not indicate the existence of a competitive problem.

All oil and gas companies are expected to account for one-third of the new coal production capacity planned for the 1979–1988 period. Of all planned production expansion between 1979 and 1988, the eight majors are expected to account for 13.4 percent, and the 23 largest oil and gas producers for 21.6 percent. Rough estimates of their shares of future coal production capacity indicate that the eight majors will account for 9.6 percent of 1988 production capacity (about three times their 1978 production share). The 23 largest oil and gas producers are expected to account for 16.4 percent of 1988 coal-capacity. The eight majors are expected to account for 20 percent of 1988 coal production capacity in the Northern Plains region. These relatively high shares do not indicate that the petroleum companies will possess market power, however, because of the ease of entry into the industry (especially with the resumption of Federal coal leasing). Moreover, there are several indications that geographic coal markets are expanding and that the Northern Plains will not be readily distinguishable from other areas in the Western coal market in 1988.

In 1978, the group of 17 companies classified as nuclear fuel firms held only 15.7 percent of United States coal reserves. Their shares of 1978 coal production were low nationally and in all regions except the Southwest, where their share was 33.9 percent; however, these companies account for only 10.8 percent of the Southwest region's planned coal production capacity expansion over the 1979–1988 period.

2. The Withholding Theory. Theoretically, it is possible that the entry of petroleum and nuclear companies into the coal industry could have adverse effects on interfuel competition (i.e., competition between coal and oil, gas, or nuclear fuel). It has been suggested that if these companies control substantial amounts of coal, they may restrict coal supply (by withholding reserves, slowing the rate of production, and retarding technological progress) in order to protect their petroleum or nuclear investments from competition from coal. Also, it is possible that firms with the power to set monopoly prices for one fuel would set even higher prices because the reduced sales of that fuel would be offset by increased sales of the alternative fuel. These possible situations have been termed the "withholding theory" and the "kickback theory."

An analysis of current and foreseeable future conditions in the energy industries indicates that there is a low probability of withholding and kickback effects, for the following reasons:

1. There is a low degree of interfuel substitutability. For several reasons, moderate changes in the price of one fuel have little effect on the demand for the other. These include the large price differential between coal and petroleum, government regulations prohibiting the use of petroleum where coal can be used, and the relatively small influence

of uranium prices on the choice between nuclear or coal power plants. Since they trade in essentially separate markets, changes in the supply of coal would have little effect on the value of petroleum or uranium.

2. Evidence indicates that neither oil and gas companies nor nuclear fuel firms possess market power in the coal industry. If they attempted to restrict coal production, other companies would expand their output or new firms would enter the market.

3. Recent studies have concluded that the structure of the uranium industry is conducive to competition.

4. The ability of petroleum companies to exert concerted economic or political power is limited by substantial interfirm differences in their interests which result from differences in their asset and revenue structures (e.g., coal revenues as a percent of total revenues), differences in the location and type of coal reserves, and differences in their primary coal markets. This structural diversity also leads to substantial differences in firm behavior, such as the rate of production capacity expansion, capital expenditures, reserve acquisition expenditures, and research and development (R&D) efforts.

3. Effects on Industry Competition and Performance. Contrary to what would be expected according to the withholding theory, oil and gas companies have made substantial contributions to the development of the coal industry. Ten petroleum companies alone invested about $2.5 billion in the coal business during the five years between 1974 and 1978. An estimated $789 million of this was provided by *de novo* entrants. Petroleum companies that have entered the coal business on a grass-roots basis and that will develop their own coal reserves plan to add about 190 million tons of new production capacity by 1988. This represents nearly 25 percent of the new production capacity planned by the industry for the 1979–1988 period. Thus, even if petroleum companies that acquired coal companies do not expand production any more than the acquired company would have (without the merger), the grass-roots development of new reserves by oil and gas companies will contribute substantially to future U.S. coal production.

Large petroleum companies also have brought to the coal industry considerable experience in the management of large capital-intensive investment projects with long gestation periods. It is this type of project that will be in the forefront of the coal industry's development. In addition, oil and gas companies have applied much of their technological know-how toward improving coal exploration, production, combustion, and conversion processes. They are leaders in coal research, with eight petroleum companies accounting for 41 percent of privately-funded coal R&D expenditures over the 1974–1977 period. This excludes the R&D expenditures of Texaco and Standard Oil of Ohio, which undoubtedly would have increased the percentage significantly.

To date, the entry of petroleum companies into the coal industry has tended to have a favorable effect on the competitive structure of the industry. The new production of *de novo* entrants has tended to create company turnover and to reduce seller concentration in some markets.

4. Policy Implications. In view of the substantial contributions of oil and gas companies to the coal industry and the absence of significant anticompetitive effects in the foreseeable future, prohibiting petroleum companies from acquiring additional coal assets (or requiring them to divest the coal assets they own) would have unnecessary adverse economic effects. The probable results would be reduced investment, less efficient production, less R&D, higher coal prices, and greater reliance on foreign petroleum supplies to meet energy demand.

The former Director of the FTC's Bureau of Competition has recommended that a limit, or "cap," be placed on the amount of coal reserves that can be held by large oil companies. The cap would be set high enough for petroleum firms to hold several times the amount of coal necessary to supply a synthetic fuel plant and several electric utility plants. The cap would be adjusted as economies of scale change and as reserve estimates change. Although this regulation would capture much of the benefit of petroleum company participation in the coal industry, it would require the establishment of a regulatory system that would have to handle complex questions. Considering the absence of evidence that oil and gas company involvement in the coal industry will have significant anticompetitive effects in the foreseeable future, it is probable that the costs of such a regulatory program would far outweigh its benefits.

The coal industry is highly dynamic, partly because of changing environmental and energy regulations. Therefore, changing conditions should be monitored in order to detect any nascent competitive problems stemming from the participation of companies with other energy interests in the coal industry.

B. Electric Utilities

1. Entry into the Coal Industry. Captive coal results when a natural monopolist, the electric utility, vertically integrates into an intermediate product stage, the production of coal, for use in the generation of electric power.[10] Captive coal is rapidly increasing in importance as a source of coal for the electric utilities. In 1965, about 5.5 percent of all coal used by electric utilities came from captive mines. In 1978, captive coal deliveries totaled 67 million tons, or about 14 percent of total coal deliveries to the electric utilities. Captive coal production is projected to account for 20 percent of projected 1985 total utility coal consumption.

The major growth in captive coal will be for utilities West of the Mississippi River. In 1978, the Western utilities used 55 percent of the total 67 million tons of captive coal. By 1985, utilities located in the West are projected to use about 68 percent of the projected total captive coal production of 143 million tons.

The major potential benefit of captive coal is the increased security of supply and coal quality reliability. Generally, the competitive nature of the coal industry would result in reliable supplies of acceptable quality; and historically, the utilities have relied primarily on long-term contracts with independent suppliers to get coal in the quantity and quality needed. However, in recent years, circumstances such as changing environmental regulations for both the coal producers and the utilities, rapidly increasing costs of coal production, and rapidly increasing coal prices (not always cost related) have resulted in a situation where some coal suppliers and utilities have been reluctant to sign long-term coal supply contracts which may prove disadvantageous in the future. Some utilities have turned to captive coal as a solution to these problems.

Other benefits of captive coal to the electric utility include profits as great or greater than the rate of return being earned by the regulated electric utility, some protection against coal price increases that are not cost related (e.g., coal supply shortfalls), and some leverage in negotiating with independent coal producers.

2. Effects on Industry Competition and Performance. Captive coal is vertical integration by an electric utility, a

[10] Captive coal is defined here as outright ownership and operation of the coal mining facility, or utility ownership of the coal reserves with an arrangement with an independent mining company to mine the coal, or, as in a few cases, having a loan or loan guarantee arrangement with a coal mining company which makes it something less than an arms-length transaction.

regulated monopolist. When a monopolist is regulated to limit the rate of return earned, vertical integration can be used as a means of circumventing regulations to gain some or all of the monopoly level of profits. Inefficiencies may result from such vertical integration. There is an incentive for a monopolist regulated at the intermediate stage to integrate to increase total profits by creating a new investment base (the intermediate stage) against which it will earn the regulated rate of return. The regulated monopolits would also have an incentive to use an inefficient capital/labor mix in the intermediate stage by putting undue emphasis on adding capital to increase the investment base. Furthermore, it may accept inflated prices for capital inputs to the intermediate stage to pad the investment base.

Based on statistical analyses of coal mine productivity and coal prices, the segment of the coal industry captive to the electric utilities appears to be performing in an economically less efficient manner than comparable non-integrated coal mines. It should be noted that this conclusion is based only on data from mines east of the Mississippi. Moreover, other methodological difficulties may exist in the anlysis. From a technical efficiency standpoint, the captive mines analyzed appeared significantly less productive than comparable noncaptive mines. The captive mines had an average productivity index of 13.06 tons per-man-day compared to 16.73 tons per-man-day noncaptive mines.

From an allocative efficiency standpoint, the captive coal prices analyzed were signficantly higher than comparable noncaptive coal prices. The prices of captive coal delivered to utilities averaged 140.5 cents per million BTU compared to 122.3 cents per million BTU for noncaptive prices.

3. The Effect of Captive Coal on Market Structure. In the markets analyzed, the effect of captive coal on market structure has been minimal or beneficial. Only in the Southwest are there potential problems. The Southwest is a highly concentrated coal market, with a small number of buyers and sellers. It is in this region, where captive coal makes up a significant part of the coal supply, that it has the greatest effects on the coal market. Captive coal has both a positive and a negative effect on competition in the Southwest. Captive coal increases competition because it gives the utilities a supply alternative if noncaptive coal producers are not competitive. A utility that controls captive coal reserves would have the option of producing its own coal if it does not receive competitive offers from independent coal producers.

The potential anticompetitive impact of captive coal operations is that, once a utility sets up an affiliate operation to produce coal, it may rely on the affiliate for all its future coal needs without negotiating with independent coal suppliers. This arrangement would not only reduce the number of potential buyers in a market with few buyers, but also lessen the opportunities for new coal companies to enter the market and compete for the utilities' business.

4. The Effect of Coal Contract Size and Length. If an electric utility does not have a captive operation, it must buy coal on the open market and use some form of contracting mechanism. The size and length of coal contracts have substantial implications for coal industry competition because large, long-term contracts act to increase the concentration of sellers in a market and because they can be barriers to entry into coal production for prospective coal suppliers. The length and size of a coal contract also affect the number of times a buying utility must transact in the market place to satisfy the lifetime coal requirements of a power plant. The smaller the percentage of a plant's requirements that are covered by a contract and the shorter its duration, the greater the number of coal supply agreements necessary to satisfy the needs of the plant and, consequently, the greater the number of opportunities for potential suppliers to compete for contracts.

Offsetting these considerations of larger contract size and longer contract duration are the lower coal prices associated with them. Long-term coal supply agreements offer a number of potential means for coal suppliers to increase the efficiency of their production performance over performance under short-term agreements. Credit is typically more available and less expensive when the sale of a mine's total output is guaranteed to a large plant for the entire life of the mine. By ensuring sales of a mine's output for a long term, mine operations can occur at a constant, planned rate which allows optimal employment of equipment and personnel, and avoids excessively high fixed and variable costs associated with fluctuations in the rate of production. Long-term coal supply agreements can provide information on utilities' long-term demand for coal and suppliers' commitments. Improved knowledge of coal demand and supply allows suppliers the opportunity to be prepared to bid for the rights to supply coal and to plan their coal reserve acquisitions and mining accordingly. The knowledge of utilities' demand for coal that can be gained from contract information also can increase coal production efficiency by facilitating more timely mine openings and rates of production. Larger and longer coal supply agreements also typically include well defined performance and incentive clauses for the seller and buyer.

Long-term contracts also provide the commitment necessary for the buying utility to take advantage of such transportation efficiencies as unit trains from mine to plant, for which the fixed costs would be too high for shorter time periods if the transportation were not already extant. Contracts for the expected life of a plant and mine are essential to justify most mine-mouth plants, which virtually eliminate coal transportation costs. Long-term contracts also decrease the frequency with which buyers have to incur the transaction costs of supplier search and evaluation, and contract negotiations. Prices for coal delivered under long-term contracts are also more stable and, therefore, more predictable for the utility.

5. The Effect of Utilities' Supplier Selection Practices. Searching for a reliable coal supplier is a process which should begin with a determination of all of the suppliers that might be able to economically supply a utility's coal needs. The subjective or ignorant exclusion of any potential suppliers from consideration creates barriers to entry into coal production, decreases the number of competitors, and might eliminate the most qualified supplier.

Utilities' solicitation of potential coal suppliers for bids varies from vigorous, objective efforts to casual, subjective efforts. The objectivity and breadth of the utility solicitation effort is important to the maintenance of a competitive coal production environment, particularly in the interests of allowing new suppliers, to compete for contracts.

Choosing to solicit bids from reputable suppliers not only benefits the coal buying utility, but also serves to eliminate the less reliable supplier from the market place. However, emphasis on supplier reliability also causes utilities to be biased toward suppliers that have supplied them or other utilities previously, and occasionally creates entry barriers for new and potentially better suppliers.

Based upon FERC's preliminary investigation of utilities' coal procurement practices suggests that many coal-buying utilities do not conduct thorough investigations of

supplier reliability and the feasibility of mining their respective coal reserves, and the utilities' negotiation and administration of coal supply agreements frequently lack deliberation and expertise. This shortcoming is evidenced by the preliminary findings in FERC's investigation, by the many utility coal contracts which FERC staff judges to be poorly written, and by the wide range in rates of coal price increases that exist within market regions.

In summary, it appears that the number of coal-buying utilities using supplier selection practices which stimulate efficient production performance and competition in the coal industry is about equal to the number which do not.

6. Policy Implications. Based on statistical analysis of coal mine productivity and coal prices, coal mines captive to the electric utilities appear to be performing in a less economically efficient manner than comparable non-integrated coal mines. There is also evidence, however, that adverse efficiency effects may depend on the quality of electric utility regulation and particularly the method used to regulate the transfer price of captive coal.

.The increasing tendency for utilities to establish captive coal operations may lessen the opportunities for new coal companies to enter the market. This consideration must be weighed against the benefit of utilities having the option of producing their own coal if they do not receive competitive offers from independent coal producers.

The trend toward large, long-term contracts also may present a barrier to entry by small coal producers. It seems clear, however, that the numerous efficiencies stemming from the use of long-term contracts far outweigh any competitive benefit from encouraging the use of short-term contracts by small-scale producers.

Finally, it appears that the supplier selection practices of a significant proportion of electric utilities could be improved to stimulate efficient production performance and competition in the coal industry.

C. The Railroads

1. Entry into the Coal Industry. Beginning in 1850, the development of the West was encouraged by granting the railroads large amounts of Federal land. Each grant consisted of a right-of-way plus alternate sections of land on each side of the line, with a resulting "checkerboard" pattern of railroad and Federal lands. These lands contain some of the largest coal deposits in the United States. Three railroads (the Burlington Northern, the Union Pacific, and the Santa Fe) currently own over 16 billion tons of coal reserves, an amount as much as 25 percent of the total non-Federal coal reserves in the Western coal markets.

In recent years, each of these railroads has been active in marketing its coal, usually by leasing their reserves to coal mining companies. The railroads also have begun to mine their coal by establishing subsidiaries that enter joint ventures with coal producers.

2. Theoretical Implications. A railroad with an interest in the coal industry (through ownership of coal reserves, for example) could find it profitable to restrict the amount of coal transported. By doing so, it would drive up the price of coal and share in the increased coal profits. Three conditions must be met in order for this competitive problem to occur:

a. The railroad must have market power over the transportation of coal.

b. The profits from the restriction of coal transportation must exceed the profits from coal transportation. This depends principally on the railroad's share of the coal market and the effectiveness of railroad rate regulation. The railroad will not restrict coal transportation if it can obtain significant monopoly profits from transporting coal.

c. The railroad must be able to restrict service, for example, by failing to build new track, to supply sufficient equipment, or to offer unit train service. Service regulation must be ineffective.

3. Effects on Industry Competition and Performance. Although two of the three conditions discussed above (generally effective rate regulation and ineffective service regulation) exist in the Western railroad industry, only the Burlington Northern has market power or can restrict the output of transportation services by failing to increase the capacity of its rail network without violating the Interstate Commerce Act. Rates were found to be well below monopoly levels, but probably somewhat above long run marginal cost. Thus, some small degree of participation in the coal industry by the Burlington Northern would not be anticompetitive. The critical participation level cannot be determined percisely, but, with rates very near to long-run marginal cost, only very modest coal holdings are necessary to provide an incentive for anticompetitive conduct. Yet the Burlington Northern already has substantial coal reserves and is a leading reserve holder in the Northern Plains coal market.

4. Policy Implications. Unless railroad service is regulated more effectively, it seems possible that the leasing of Federal coal reserves to the Burlington Northern would have an anticompetitive effect. On the other hand, competitive transportation rates may significantly exceed current rates, so that, if rates were significantly increased, the Burlington Northern might not have the incentive to restrict transportation services in order to reap monopoly profits from its coal holdings. Furthermore, although the Burlington Northern is a leading resource holder, it produces no coal itself, and its lessees currently produce relatively little coal from Burlington Northern properties. Thus, the Burlington Northern might not find that a transportation restriction would lead to monopoly profits in its coal holdings even at current transportation rates.

*IV. Government Intervention*

Government intervention in the coal industry has given rise to serious debate. On the one hand, government interventionists argue that the government interventionists argue that the government should intervene if the marketplace is not working well, with the result that many socially desirable functions are not being performed or are being performed inadequately. On the other hand, government noninterventionists argue that the government should not intervene or should reduce its role since it has usurped many of the functions that can and should be performed by the marketplace more efficiently. Even where opponents agree that intervention may be necessary, they argue, the form of intervention has been more costly than necessary.

While this study cannot provide definitive answers to these arguments, it can shed light on the competitive effects of government intervention in the coal industry. The analyses usually focus on two implications of government intervention, its dynamic effect on market boundaries and its effect on conditions of entry. Each of the following areas will be discussed: environment, technology, fuel choice legislation, transportation, taxation, leasing, and lead times.

A. Environment

This section will discuss the clean air laws and their dynamic effects. Government intervention in this area was deemed necessary since the marketplace was not providing an adequate solution to industrial pollution. As a result of this government intervention, significant changes have occurred in the coal markets.

1. Role of Government. The major impact discussed here reults from the requirements imposed by the clean air

laws on the electric utility industry. The most important laws are the Clean Air Act Amendments of 1970 and 1977. The 1970 amendments imposed, among other things, a limitation on the emission of sulfur dioxide ($SO_2$). this limitation required that all new utility coal-fired steam generators above a certain size to limit their $SO_2$ emissions to 1.2 pounds per million Btu of heat input. Under this standard, utilities could burn medium- and high-sulfur coal by using some process to reduce $SO_2$ emissions (cleaning or scrubbing), or they could burn low-sulfur coal without cleaning or scrubbing. With the 1977 Amendments, not only was the emission limitation retained, but a percentage reduction on all $SO_2$ was imposed.

For all new electric utility steam generators constructed after September 18, 1978, an emission limitation of 1.2 pounds of $SO_2$ per million Btu of heat input was imposed and a reduction of $SO_2$ emissions by 90 percent must occur. An exception was made for low-sulfur coals which emit 0.6 pounds or less of $SO_2$ per million Btu of heat input and, which can reduce emissions by 70 percent. The major differences between the 1970 and 1977 Amendments is that no coal can be burned without some reduction in emissions through cleaning or scrubbing.

2. Dynamic Implications. From a competition perspective, one of the major changes brought about by these laws is the change in both product and geographic markets. For product market, in the short-term, utilities with existing boilers may be required to burn specific types of coal to meet emission limitations. This short-tern effect can fragment the product markets into compliance (those coals burned without scrubbing) and noncompliance coals. In the long-term, however, a utility designing a new boiler has a wider choice of coal and cleaning combinations. Therefore, the entire range of coals becomes available, and the product market no longer is fragmented.

The geographic changes in the coal market have been much more dramatic. Due in large part to the clean air laws, what was once a formerly compartmentalized industry, with rather discrete geographic market boundaries, has become much more dynamic, with significant shifts in geographic boundaries.

Given a range of emission choices, a utility can consider a broad array of coal and cleaning alternatives. The ultimate choice usually depends on economics (although noneconomic factors sometimes may be decisive). Without the clean air laws, utilities more than likely would use more medium- and high-sulfur coal since it is usually located closer to the point of consumption. With the implementation of the 1970 amendments, utilities could choose medium- or high-sulfur coal (usually located in the East or Midwest) with a scrubber, or use more distant low-sulfur coal (usually located in the West). Throughout the 1970s this choice radically changed market boundaries, with the result that Midwest utilities increasingly turned to low-sulfur Western coal. From the Midwestern utilities' perspective, therefore, geographic coal markets expanded to include new Western coal sources.

Western coal penetration into traditional Eastern and Midwestern coal markets depends to a large extent on the stringency of the clean air laws. With just the 1970 amendments, this penetration was large, since the most economic choice often meant burning Western low-sulfur coal. With the 1977 Amendments and the requirement to scrub all coals (albeit to varying degrees), the penetration of Western coal may be slowed since it may become cheaper to scrub medium- and high-sulfur coal located nearby than to transport and scrub low-sulfur Western coal.

In any event market boundaries will change as a result of these laws. Their initial imposition created dramatic changes in geographic markets, and new and more stringent standards again will cause market shifts to take place.

The implications of such dynamic changes in geographic markets are significant. The expansion of geographic markets can reduce seller concentration if the geographic expansion adds substantially to the number of sellers comprising the regional market, as happened in the Midwest. For example, a previous study found the Midwest market in the 1960s relatively insulated from competition and operating essentially like a tight oligo-poly.[1] The expansion of the market to encompass a larger geographic area has had the effect of exposing this region to greater actual and potential competition and of bringing the market structure closer to the competitive model.

3. Entry Implications. Environmental regulations can have effects on entry. Imposing stringent environmental regulations on the way coal is mined can increase entry barriers into the industry by making it more costly to enter initially and to remain competitive after entry. This entry-forestalling effect is discussed in the section on lead times. The competitive viability effect after entry stems from the additional costs required to mine in an environmentally acceptable manner. If environmental costs are similar for large and small mines, then their effect on smaller mines is greater since costs are spread out over fewer tons of coal. As mine-mouth prices rise or profitability decreases as prices remain constant, small mines may be competitively disadvantaged. The demise of small mines can alter the structure of the industry by increasing concentration among the remaining firms. This study, however, did not undertake to examine the costs imposed on mining coal as a result of environmental regulations.

B. Technology

The major role of the government in technology is through funding of R&D in the coal industry. The degree to which the Federal government supports new technologies can affect the rate of innovative activity. To the extent that government funds are available, technological innovation may accelerate, alter cost structures and coal usage, and thereby create additional pressures for changes in coal markets.

1. Role of Government. The Federal government has funded R&D programs to improve the technology for converting coals to synthetic liquid and gaseous fuels for the direct combustion of coal (fluidized bed combustion, for example), and for improved mining techniques.

2. Dynamic Implications. In a recent study, EIA examined the impact upon forecasted 1990 coal production if coal demonstration programs for synthetic fuel development were not funded. The study found that total coal consumption would be virtually unaffected, reducing projected 1990 production by a meager 13 million tons. Beyond 1990, however, the impacts may grow as the synthetic fuel industry becomes commercially viable. The projected reduction in consumption is too speculative to quantify, however.

The elimination of such government funding apparently will have no impact on geographic coal markets. From the product market perspective, however, the commercialization of coal-based synthetic fuels may extend the substitutability of coal for natural gas and oil. Given all the uncertainties surrounding the time when commercialization of synthetic fuels will be economic, the competitive implications of this indirect substitution are too speculative and are too far off in the future. Government intervention or nonintervention in the synthetic fuel industry apparently has few direct

[1] Reed Moyer, *Competition in the Midwestern Coal Industry* (Cambridge, MA: Harvard University Press, 1964).

effects on the dynamic interplay of coal markets at least through 1990.

C. Fuel Choice Legislation

1. Role of Government. PIFUA requires certain new electric utility steam generators and certain new industrial major fuel burning installations to use a fuel other than oil and gas, with certain limited exceptions. To the degree that fuel choice is restricted by government fiat, it may have some implications for the competitiveness of the coal industry.

2. Dynamic Implications. A recent EIA study examined the effects of this legislation on the coal industry. The result of removing PIFUA would be a drop in coal consumption by electric utilities of about 35 million tons in 1990. The reason for the drop is that electric utilities which would have been forced to burn coal for electricity generation would switch to gas, especially in regions such as the South Atlantic and Gulf Coast areas, where gas is more plentiful and cheaper than coal. Coal production declines would be spread evenly between East and West.

The effects of fuel choice intervention on competition appear minimal. Geographic markets appear minimally affected. Some effect may appear on the product side, since product definitions depend, among other things, on interfuel substitutability. If PIFUA limitations are eliminated, then the present assumptions about actual interfuel substitutability may require renewed analysis. Generally, however, fuel choice intervention appears to have little effect on coal market boundaries.

D. Transportation

Transportation costs and availabilitiy have a dual effect on competiton in the coal industry. Transportation costs are a primary factor imparting both regionality and dynamic qualitites to the coal industry. Transportation availability can effect entry conditions by affecting access to potential coal producing areas and to consumption areas.

1. Role of Government. Government intervention in this area is pervasive with respect to transportation costs since the Interstate Commerce Commission (ICC) regulates railroad rates (the cost of transportation services to transportation users). While the ICC also regulates transportation availability to some extent (for example, rail additions must be approved by the ICC), the impetus for new rail lines must come from the railroads since the ICC has little or no authority to order significant rail additions.

2. Dynamic Implications. Transportation costs assume a large portion of delivered costs because coal is a bulky commodity relative to its cost. For instance, in the West, transportation costs can represent in excess of 50 percent of delivered costs; in the East, the transportation component is substantially less. Due to this substantial difference in contribution to delivered costs, coal markets assume a regional character since all coals cannot compete on a delivered-price basis in all markets.

Changing transportation cost impart a dynamic quality to these regional boundaries. As transportation costs vary, so do regional boundaries. The larger portion of delivered costs represented by transportation costs, the greater the potential variability or change in regional boundaries. For example, the introduction of unit train rates (rates based on the shipment of coal only as opposed to single car rates) substantially reduced transportation costs and thereby made Western coals (which had lower mine mouth costs to begin with) more desirable in distant markets such as the Midwest and South Central states. Even though the clean air laws made low-sulfur Western coal more desirable, the substantial reduction in delivered prices caused by the introduction of unit trains assisted in making Western coal competitive in Midwest and South Central markets.

In recognition of the importance of transportation costs to the competitiveness of coal markets, DOE is examining the sensitivity of market boundaries, among other things, to coal transportation rate changes. Since this examination has not been completed, it is premature to draw any specific conclusions other than the more general ones indicated above.

3. Entry Implications. The question of transportation availability and particularly railroad availability to meet future coal production requirements recently has been addressed in joint Department of Transportation/DOE study entitled National Energy Transportation Study (NETS).

NETS suggests that, by 1985, congestion on routes in Wyoming, Colorado, Nebraska, and Illinois, and in the St. Louis area can be expected. In the East, similar congestion can be expected on routes in West Virginia, Kentucky, and western Virginia.

By 1990, a greater number of routes become congested, especially if less oil is used than presently anticipated. This greater congestion results in serious bottlenecks in the West and incipient capacity problems especially in the Powder River Basin area of Wyoming and Montana. Since this is the critical production area in the West, the implications may be substantial.

Transportation alternatives to railroads, especially in the West are limited. Where there is access to waterways, barges and inland lake transports can be used. Here too, the NETS Study found some substantial congestion especially on some of the major waterways. In the West, however, the primary transportation alternative is the coal slurry pipleline. (Coal by wire, the transmission of electricity over high voltage lines from mine-mouth generating plants, can be an alternative and is discussed in NETS.) Coal slurry pipelines have been found to be effective competitors over long distances with railroads. The future availability of this transportation system can help ameliorate the potential capacity problems created by overloading the rail transportation system.

The inability of present or new entrants to gain access to the transportation system can impede entry into the coal industry. If rail availability is constrained in the most important Western producing region, the Power River Basin, then other more costly areas must increase production to offset the constrained production from the Power River Basin. The result can lead to increased coal costs either because the coal that is produced to meet forecasts is more costly or because decreased supplies in the face of increased demand may lead to more intense bidding up the price of available supplies. The implication is that existing producers may be able to increase their market power and affect prices since new competitors cannot enter easily to offset this price increase and bring the market back to or closer to competitive equilibrium.

While this competition study has not assessed the accuracy of NETS or other studies predicting similar rail congestion, the implication to be drawn from these studies is that the competitive process, especially in Western markets, may be seriously affected by inadequate transportation facilities.

E. Taxation

Federal and state tax programs can impart dynamic qualities to market definitions, and they can affect the conditions of entry into the coal industry.

1. Role of Government. The most important tax programs considered in this study are state severance taxes, Federal royalty payments, and the depletion allowance. State coal

severance taxes are excise taxes that are primarily revenue generating to ameliorate some negative impacts of coal development on communities in the state. Royalty payments to the Federal government for coal mining on Federal lands really are not a tax, but a factor payment; mine operators are buying coal from its owner, the Federal government. But if the royalty charged by the Federal government exceeds that charged by private owners, then the extra Federal royalties can be considered a tax similar to the excise tax. The effect of the excise tax (and the royalty payment, if it act as a tax) is to decrease industry output and increase prices to the consumer. Finally, the depletion allowance is a form of negative taxation. It is intended to offset the effects of the corporate income tax on highly capital-intensive industries, such as mineral extraction. Many believe that the depletion allowance leads to increased investment in extractive resources such as coal and leads to more output and lower prices than would be the case without the allowance.

2. Dynamic Implication. In a recent study, the EIA projected coal production with and without the Federal and state taxes indicated above. The results of the study indicate that while overall coal production does not change very much, regional production changes significantly. Overall, without the taxes, national coal production would increase marginally (by about 23 million tons). But the removal of the taxes causes a significant shift in coal production from Eastern and Midwestern medium and high-sulfur bituminous coal (64 million tons) to Western low-sulfur subbituminous coal (140 million tons).

The shift reflects several factors. These are higher state severance taxes in the West than the East or Midwest. Federal royalty payments have a greater effect on Western production since relatively more Western coal than Eastern or Midwestern coal is produced from Federal lands. Unchanging environmental regulations mean that the economics of using various sulfur-level coals is unchanged. Finally, the removal of the depletion allowance causes higher net coal prices in the East since severance taxes and Federal royalty payments do not offset the impact of the depletion allowance while, in the West, the increase due to the removal of the depletion allowance is more than offset by removal of the much higher state severance taxes.

Taken together, the removal of these tax programs can be expected to reduce significantly the cost of coal production in the West. With such cost reductions, coal users can be expected to shift a significant part of their demand to the West. The implication from this theoretical analysis is that Western coal would be expected to increase its penetration into markets supplied by medium- and high-sulfur Eastern and Midwestern producing regions. Concentration can increase or decrease, depending upon how the geographic markets are altered, the addition or subtraction of industry participants in those markets, and the incentive of new firms to enter as a consequence of the increased demand in the West or to exit as a consequence of decreased demand in the east or Midwest.

3. Entry Implications. The focus of this section is on the excise tax, which has some direct and indirect effects on entry. Principally, the direct effects of a state excise tax are that revenue will be raised by the taxing authority, the quantity of coal produced and consumed will fall, and economic burdens will be imposed both on buyers, who pay a higher price than before the imposition of the tax, and on sellers, who receive a lower net price.

The direct effects can depend on the price sensitivity of the buyer or seller and on the period of time involved. The market participant whose behavior is price sensitive can shift part of the tax burden to others and bear less of the tax burden directly. In the short run, the tax can be expected to raise more revenues as sellers and buyers have fewer alternatives. It is likely that coal producers will be able to pass along the excise tax to coal buyers, such as electric utilities and industrial users. However, in the long run, as buyers and sellers can adjust to the effects of the tax, it can be expected to raise less revenue and reduce output more than in the short run. Moreover, coal buyers may look elsewhere if the effect of the tax is substantial, thereby reducing the quantity of coal demanded.

In this long-run situation, the indirect effects of the excise tax become more important. The coal producer, now forced to reduce output and most likely to reduce profitability, will shift some of this burden to others, principally its suppliers of land, labor, and equipment. Also, in the long run, it can be expected that investment in mining will be reduced because of lowered expectations on the return on investment.

This situation has a differential effect due to the large variations in state excise taxes. With some states imposing large excise taxes, both exploration for new coal sources and new mine openings or expansions may be inhibited due to lower rate of return expectations. Such an effect can inhibit entry in those states and affect the overall competitiveness of the industry. For this reason, existing industry members may be able to affect prices and output with less fear that new entry and its price/output disciplining effect, will restore the industry to competitive equilibrium.

Thus, taxation programs can affect both market dynamics and entry conditions. While no suggestion is made that these tax programs should be eliminated, the large differences among the levels of the taxes can pose some problems for the overall competitiveness of the industry.

F. Federal Leasing

With the shift of coal production away from production predominantly in the East to production distributed more evenly between East and West, coal production growth in the West can be expected to be enormous. The Federal government owns approximately 60 percent of Western coal reserves and another 20 percent are dependent on the availability of complementary Federal coal for its production. The orderly leasing of Federal coal in the West can affect the ability of the West to meet the forecasted production goals. The orderly leasing of Federal coal also has substantial implications for competition in terms of both market dynamics and entry conditions.

1. Role of Government. The Federal government has evolved a complex process for the leasing of its coal reserves. The six-year process is broken down into a four-year land-use planning stage, and a two-year activity planning stage. In the land-use planning stage, DOI's goal is to identify areas acceptable for further consideration for coal leasing. This process involves screening out areas that for one reason or another are not suitable: the areas have coal reserves of low development potential or they are environmentally unsuitable for leasing or there are multiple-use trade-offs that make them more valuable for other uses or they are preferred for nonmining uses by the surface owners. The hallmark of the entire land-use process is that it is governmentally initiated and carried out.

In the activity planning phase, DOI selects for sale, from the tracts identified during the land-use planning stage, a sufficient number of tracts to meet regional leasing targets. Activity planning includes the following steps: requests from the industry for expressions of interest in leasing possible tracts; preliminary tract delineation; site-specific analyses of the

delineated tracts; tract ranking on the basis of environmental, social, and economic effects and a cumulative analysis of the tracts; selection of lease sale schedule alternatives; and preparation of regional lease sale environmental impact statements.

2. Dynamic Implications. A recent EIA study examined the impact on coal production of Federal leasing policy. The study examined 1990 coal production based upon the orderly leasing of coal according to present policies versus 1990 production without any Federal leasing. A continuation of the Federal moratorium on coal will affect 1990 coal production.[12] While total national production would decline insignificantly (about 8 million tons). Western production would decline substantially (about 67 million tons). The Western decrease would be largely offset by increased expansion of Applachian and Midwest production of 42 million and 15 million tons respectively.

Generally, the effects of a coal-leasing moratorium on Federal lands are a function of the reserves affected and of the cumulative level of reserve commitment. The cumulative level of reserve commitment is a function of the demand for coal and the forecast period. Therefore, at any given rate of demand growth, the impacts will grow progressively greater over time and also will be greater if the forecasted coal demand is increased.

The implications for markets appear to be significant. With Western production curtailed to a significant degree, demand would be made up by Appalachian and Midwestern production. With less penetration of Western coal, shifts in market boundaries may occur. Actual and potential competition within these new boundries can be affected as a result.

A similar dynamic effect can occur even with renewed Federal leasing if the amount of coal leased falls below the amount necessary to maintain a competitive industry. The amount of coal leased is a function of the targets set by DOI during its activity planning stage. In turn, the targets depend on DOE production goals.

DOE establishes its production goals on the basis of a modeling approach. It continuously updates and revises these goals, which are based on a large number of variables. The adequacy of these goals depends to a large extent upon the assumptions that are used in the model, and substantial variations in production goals may result from small changes in the assumptions.

DOI uses the DOE's production goals as part of its leasing targets. Using a formula for establishing its targets, the DOI sets a leasing schedule that will meet these targets. The methodology used by DOI has come under criticism by GAO, COWPS and DOJ, among others. This criticism, however, was aimed at the first lease sale by DOI, which by DOE's admission was scheduled somewhat hastily in order to get the coal leasing program going again. Future lease sales have been programmed with less haste, and therefore, may not be subject to similar criticism. The implication to be drawn from this criticism is that not enough coal may be leased and production shortfalls may occur in the future due to leasing shortfalls. The effect on markets may be less than in the no-leasing situation, but, nonetheless, the competitiveness of the industry may be substantially affected.

3. Entry Implications. The lack of leasing or shortfalls in leasing also may affect the conditions of entry. Moreover, the present leasing process may inhibit entry even if leasing is adequate.

The effect of no new leasing or inadequate leasing may affect market structure substantially. Existing producers may be able to increase their market share by expanding present operations without fear of entry by new companies since entry may be blocked because minable lands are not available. With the possibility of increasing market share, concentration may increase, and the likelihood that existing industry participants can exert more control over pricing/output decisions increases. The most significant force restraining this tendency in entry into the market. If entry is restrained because inadequate coal leases are available from the Federal government, then the moderating effects of entry on concentration may be eliminated or reduced. The entire competitive process will tend to be undermined.

Even if leasing is adequate, the present land-using planning and activity planning process may inhibit entry because of problems with the resource data, adequate public participation before a final decision, multiple-use trade-offs, and Regional Coal Teams (RCTs). It must be noted that many of the problems identified in this study may result only from the first lease sale scheduled for early 1981. Because of the desire to implement the coal leasing program in the shortest possible time, some problems may occur. Future lease sales will be scheduled with less haste. Therefore, the competitive problems identified may disappear in the future. These problems should be viewed only as potential ones, and depend on whether DOI responds to criticism associated with the first lease sale.

a. Resource Data Problems. In the land-use planning stage, DOI must segregate areas into areas with low, medium or high development potential. Subsequent planning proceeds in those areas considered to have medium or high potential. This planning is supposed to utilize a series of maps known as Coal Resource Occurrence/Coal Development Potential (CRO/CDP) maps generated by the U.S. Geological Survey (USGS). If the CRO/CDP maps are not available, the USGS can substitute other available data.

The major problem encountered with this system is the lack of CRO/CDP maps or the opportunity to provide data to the USGS for their equivalents. Since the CRO/CDP maps usually have not been prepared, Bureau of Land Management District Offices have been forced to create their own coal maps for land-use planning purposes. These maps often overlook new areas since better data tend to exist near existing mines and lease tracts or on areas where railroads have sought partners to mine their alternative sections.

Since USGS does not drill in unleased areas where a company proposes to drill (a decision which may be justifiable to avoid duplication and unnecessary government expenditures), and since information from the latter is not publicly available, it is difficult to assess the development potential of other areas.

The result is that a lack of adequate data for coal mapping used to delineate tracts or to recognize the development potential of existing resources tends to restrict the availability of potential new mine sites. For example, one of the two potential tracts in Utah that is likely to support development independent of an existing mine was deferred, and drilling will be done largely by a private firm.

Restricting the land-use planning to the areas where better data are available may have the unintended result purpose of preselecting future lessees. An example of the potential for the land-use planning process to determine the identity of the eventual lessee occurred in Wyoming when it was decided to limit the land-use planning for coal leasing to the area of the Union Pacific's checkerboard in

[12] Due to a host of problems in the previous leasing program, the Federal government imposed a moratorium on new leasing in 1971. Very little leasing has taken place since, except in certain circumstances to avoid mine shutdowns or the loss of the Federal coal if the operator had to mine around the reserves. Renewed leasing is scheduled for early 1981. Therefore, the EIA study using the continuation of the moratorium is only a theoretical possibility and is unrelated to actual fact.

southern Wyoming while excluding the coal lands wholly owned by the Federal government south of the checkerboard. Given the speed with which DOI moved to implement the first lease sale, this limitation may be justifiable since the tracts selected are closest to existing transportation and existing mine sites, which may increase their competitiveness, in DOI's view.

Moreover, future coal development may be restricted as private explorations occur only in areas that already have been screened in land-use plans. Even large companies have indicated that the delay and risk of non-leasing in other areas is too great to warrant initial private exploration of those areas.

If the tendency of the leasing process continues to identify those areas near present mining sites or presently leased lands and to omit less developed areas and thereby essentially to preselect lessees, then new entrants may be inhibited or prevented from acquiring Federal coal leases. The implications for the competitiveness of the Western coal industry can be substantial.

b. Unsuitability Criteria Problems. One of the screens in the land-use planning phase involves a determination of the suitability of the lands for development. DOI uses 20 unsuitability criteria derived from the Surface Mining and Reclamation Act of 1977 and other criteria from DOI policies concerning wilderness areas, endangered species, and migratory birds. The primary purpose of using all these unsuitability criteria is to minimize the risk that, if a lease is issued, the coal cannot be mined because of environmental constraints.

The application of the unsuitability criteria and the exceptions to them appear to involve considerable discretion. Substantial reliance is placed upon determinations made by other Federal and state agencies. The primary problem here is one of inability of interested parties to participate in the decision-making process in a timely manner. As a result, substantial areas may not clear the land-use planning phase or may clear it only conditionally, and development in potentially new areas may be inhibited or retarded, while primary emphasis is placed on areas where existing activity has occurred.

c. Multiple-Use Trade-Off Problems. The third major step in the land-use planning process is a consideration of multiple-use trade-offs. Two problems have occurred: a lack of adequate data to make informed multiple-use trade-off decisions and inadequate justifications for the decisions that are made. The first problem can restrict tract selection, and the second can tie up those tracts selected in administrative appeals. Both have occurred, and both can inhibit the entry of new firms.

d. Regional Coal Team Problems. The other major problem appears to be the functioning of the RCT. Federal-state committees formed to address the coal program issues in designated areas. Each RCT guides and reviews tract ranking, selection, and sale scheduling, and recommends regional lease sale alternative. The RCT's choice of tracts to be delineated and the priority given to tracts can dictate the eventual lessee.

The implications to be derived from these problems are that many potential lease tracts do not make it through the land-use and activity planning stage and that those that do may tend to favor existing industry participants, to the disadvantage of new entrants.

The decision-making process may help existing companies tie up new lease tracts through a series of administrative appeals and thereby keeps them off the lease schedule for considerable periods of time. On the other hand, potential new entrants may be frustrated in their attempts to obtain legal redress for the decisions that may preclude or inhibit their entry.

### G. Lead Times

Long lead times (the time period required to being a new coal facility into operation) tend to increase the level of entry conditions into the coal industry. Government regulation in general has had the adverse effect of lengthening lead times substantially. As a result, the ability to enter the coal industry has been inhibited and can affect the competitiveness of the industry.

1. Role of Government. Government regulations imposed under twelve different laws have had the effect of increasing lead times by 11 percent to 63 percent for various coal-related facilities. Government regulations have affected the time periods required to accomplish each phase of facility planning and construction. Planning and site selection takes longer due to environmental requirements. Environmental studies have increased lead times by as much as two years. Differences between the government and the private party over data collection and other interpretations of these studies can further extend this period. The actual approval of permits can occur rather quickly; however, the information required for the permit application has lengthened the permitting process considerably since permitting agencies require complete environmental and design data. Moreover, there is considerable risk if equipment purchases are made during the permitting process, but before final permit approval, but to wait until all permitting is finalized before equipment is ordered further increases the lead time. Depending on the demand situation, lengthy lead times can have an adverse effect on the ability to secure coal supply contracts.

2. Entry Implications. Lead times affect entry in several ways. The longer the lead time the longer it takes the coal production of new entrants to enter the marketplace. This, in turn, affects the likelihood that existing firms can set prices above competitive levels, since substantial profits could be earned until the entry occurs and bids prices back to competitive equilibrium. Long lead times increase the initial capital investment necessary to enter the coal industry, since greater amounts of capital are tied up between the inception of the planning and actual production. Finally, private efforts to shorten lead times can increase risk since there is uncertainty in getting through the permitting or regulatory process.

## V. Conclusions

The purpose of this competition study is to determine whether the coal industry can meet price and output goals in a competitively determined manner over the next decade. The answer to that question requires an evaluation of the competitive process of the coal industry, here, on the basis of a structure-behavior performance paradigm. This study concludes that the coal industry is workably competitive, with some important qualifications, and that it should be able to meet price and output goals in a competitively determined manner.

Overall, coal output has increased steadily during the past decade, at prices that appear competitively determined. While upward pressure was placed on coal prices by the sharp increase in coal demand caused by the 1973 OPEC oil embargo and by anticipation of a major coal strike in 1974, contract coal prices from 1975 through 1979 have fallen in constant dollars (i.e., dollars discounted for the effects of inflation). Spot prices have fluctuated with coal demand. This behavior is consistent with what would be expected in a competitive coal market with fluctuating demand.

According to 1978 production figures for the United States as a whole and for the three major producing regions, Appalachian, Midwestern, and Western concentration was moderate to low and decreasing in all areas except the West. A combined Midwestern-Western region indicated moderate and decreasing

concentration. Concomitantly, entry conditions are relatively easy; however, the study has found incipient problems with some entry conditions that may cause changes adverse to competition during the next decade.

Neither economies of scale nor capital requirements pose a substantial barrier to entry into the industry. Because the scale of entry by any given company is small by comparison to output in the regional markets a new entrant need have no fear of flooding a market and reducing price below cost. For large firms, capital appears relatively available from a variety of internal or external sources. For the smaller companies operating in the spot market facing different capital requirements, capital also appears to be available.

The entry conditions that appear to cause some concern involve those where government intervention has been prevalent, namely environment, transportation, taxation, leasing, and lead times. In addition to altering markets substantially over the last decade, environmental regulations have had the effect of increasing the time necessary to bring a coal-related facility on line. This intervention has increased capital requirements and risk, both of which inhibit entry. It also may delay the time when new entrants can begin production that would reduce seller concentration and compel more competitive pricing decisions.

The transportation component of the delivered price of coal has a strong influence on the geographic boundaries of coal markets. The marketing reach of coal producers is determined by the delivered price and, in turn, the delivered price determines whether a market can be entered. Since rail rates for coal are regulated by the Federal government, their level can have either a deterrant or a promotional effect.

In addition, the availability of transportation facilities to carry coal has an equally important entry effect. To the extent that coal transportation facilities are unavailable, entry is inhibited. Government policies play an important role in this process through rate regulation of railroads (financially healthy railroads can support greater rail expansion), through certificating new entry of competing rail lines, through the provision of eminent domain authority for competing sources of transportation (e.g., coal slurry pipelines), and through a number of other policies. Projections for possible rail congestion in the most important expanding production region, the Powder River Basin, presage problems both in the private and government sector during the 1985–1990 period.

Differential taxation, especially at the state level, can mean that one area will be developed more rapidly or more slowly. Such differing development can mean that less desirable coal will be developed first, at added costs to coal consumers, or that reduced profitability in one area as opposed to another can inhibit entry. Enlightened tax policies can spur production in the most desirable areas or promote entry by reducing the drain on profitability. While differential tax policies may not be inhibiting entry yet, they pose the possibility of doing so and of adversely affecting the competitive process.

Finally, the ultimate ability of new entrants to enter depends upon the availability of coal resources. Since most of the forecasted new growth in production will come from the West and since the Federal government is the largest coal resource owner in the West, the magnitude and location of coal leasing can play a crucial role in the development of the Western coal industry. This study has identified a number of areas of concern in the leasing process, starting in the land-use planning phase and proceeding through the activity planning stage. These problems have two major implications, first, that not enough coal may be leased during the next decade and, second, that what will be leased may be leased in areas that may favor present industry participants, to the disadvantage of potential entrants.

Therefore, while the present seller concentration of the industry should not present a major cause for concern, the conditions of entry, especially where government intervention has occurred, do present cause for concern. Unless the government's role in these areas is altered over the next decade, the structure of the coal industry may be adversely affected and the price/output goals for the industry for the next decade may not be met.

The evaluation of behavior and performance focuses briefly on the performance of the industry as a whole, and at length on the performance of coal companies with a horizontal relationship with other energy companies or of coal companies with a vertical relationship with coal consumers (electric utilities) or coal transporters (railroads). To the extent that these relationships create incentives for anticompetitive behavior, the performance of the coal industry can be adversely affected. However, no evidence suggests that either horizontal or vertical integration is presently a serious problem or soon likely to become one.

The entry of oil and gas companies into coal has brought claims that somehow these companies will want to withhold coal reserve development or production in order to raise coal prices to a level equal to oil and gas prices. Based on this study's assessment of interfuel substitutability, asymmetry among companies, current and future production shares, and current antitrust safeguards, no finding can be made now to impute the requisite market power to oil and gas companies to pursue successfully any withholding of coal reserves or production.

While electric utilities increasingly are relying on captive production, this reliance may lead to the creation of some inefficiencies since incentives may exist to extract a monopoly price from unregulated coal operations. This study finds that from a price and output perspective captive coal operations are less efficient than similar noncaptive coal operations. The comnpetitive implication is that resources may be misallocated, and that the market may be less than fully competitive; however, adverse efficiency effects may depend in part on the quality of electric utility regulation and particularly on the method used to regulate the transfer price of captive coal.

The effect of captive coal operations on market structure is examined in four markets. In three of the four markets, the effect is considered minimal or even procompetitive. In the fourth, the Southwest, the effect could be considerable if the number of buyers were reduced and thereby adversely affect the potential for new entrants to enter.

Where electric utilities do not operate their own production, but contract on a long-term basis, the competitive process is affected with no clear price effects, but with potential entry effects affecting small coal producers. This problem must be counterbalanced with the numerous efficiencies stemming from the use of long-term contracts, which appear to far outweigh any competitive benefit from encouraging the use of short-term contracts.

Finally, the study evaluates the participation of railroads in the coal industry to determine whether any incentives for anticompetitive behavior exist. While incentives may exist, they are very limited, since they apply to only one railroad, the Burlington Northern and even then it is quite speculative whether the BN would attempt to act in an anticompetitive manner.

Overall, the behavior and performance trends yield results that do not detract substantially from the

structural analysis. While oil and gas companies are increasing their share of production, there does not appear to be any cause for concern now or though 1990. Moreover, several factors besides asymmetry mitigate any potential market power on the part of oil and gas companies. First is the role of the Federal government in the West, which can provide the necessary coal resources to new entrants to undermine any emerging oil and gas company market power. Second is the role of the electric utilities, which can provide price discipline through their ability or threat to integrate into coal production, or through long-term contracting.

While actual integration by electric utilities appears to produce less efficient results in their captive coal operations, the phenomenon may be partly explained by inadequate regulation. This type of seller/buyer interaction exerts counterbalancing forces in the coal industry that help maintain a workably competitive process.

The general conclusion, therefore, is that an analysis employing a structure-behavior-performance paradigm finds the coal industry workably competitive, with some incipient problems due to government intervention. These should be rectified to ensure that they do not grow and to ensure that the industry remains competitive throughout the next decade.

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# Reader Aids

Federal Register

Vol. 46, No. 22

Tuesday, February 3, 1981

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## AGENCY PUBLICATION ON ASSIGNED DAYS OF THE WEEK

The following agencies have agreed to publish all documents on two assigned days of the week (Monday/Thursday or Tuesday/Friday). This is a voluntary program. (See OFR NOTICE 41 FR 32914, August 6, 1976.)

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**NOTE: As of September 2, 1980, documents from the Animal and Plant Health Inspection Service, Department of Agriculture, will no longer be assigned to the Tuesday/Friday publication schedule.**

## REMINDERS

### List of Public Laws

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Last Listing January 28, 1981

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